#17



Agilent No. 10972039-2
R&A No. 5000-0029
PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**
**BEFORE THE BOARD OF APPEALS**



In Re Application of:
Reid A. BRENNEN et al.

Serial No.: 09/233,694 Group Art Unit: 1756

Filing Date: January 19, 1999 Examiner: C. Young

Title: METHOD FOR PRODUCING HIGH-SURFACE AREA TEXTURING OF A SUBSTRATE, SUBSTRATES PREPARED THEREBY AND MASKS FOR USE THEREIN

# SUBSTITUTE BRIEF FOR APPELLANTS

Michael J. Beck, Esq.
AGILENT TECHNOLOGIES
Corporate Legal Department
1601 California Avenue, MS 17L-5A
Palo Alto, CA 94304-1126

Attorney for Appellants

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF APPEALS

In Re Application of:
Reid A. BRENNEN et al.

Serial No.: 09/233,694 Group Art Unit: 1756

Filing Date: January 19, 1999 Examiner: C. Young

Title: METHOD FOR PRODUCING HIGH-SURFACE AREA TEXTURING OF A SUBSTRATE, SUBSTRATES PREPARED THEREBY AND MASKS FOR USE THEREIN

# SUBSTITUTE BRIEF FOR APPELLANTS

## TABLE OF CONTENTS

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**
**BEFORE THE BOARD OF APPEALS**

In Re Application of:
Reid A. BRENNEN et al.

Serial No.: 09/233,694 Group Art Unit: 1756

Filing Date: January 19, 1999 Examiner: C. Young

Title: METHOD FOR PRODUCING HIGH-SURFACE AREA TEXTURING OF A SUBSTRATE, SUBSTRATES PREPARED THEREBY AND MASKS FOR USE THEREIN

## SUBSTITUTE BRIEF FOR APPELLANTS

## INDEX OF CITATIONS

**CASES** **PAGE**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF APPEALS

In Re Application of:
Reid A. BRENNEN et al.

Serial No.: 09/233,694 Group Art Unit: 1756

Filing Date: January 19, 1999 Examiner: C. Young

Title: METHOD FOR PRODUCING HIGH-SURFACE AREA TEXTURING OF A SUBSTRATE, SUBSTRATES PREPARED THEREBY AND MASKS FOR USE THEREIN

## SUBSTITUTE BRIEF FOR APPELLANTS

### INTRODUCTION

This is an appeal from the final rejection of the patent application identified above, dated September 22, 2000 (Paper No. 7). In that communication, Examiner Young in Group Art Unit 1756 finally rejected claims 23-27, 29-46, 48-50, 52-69, 77 and 78 under 35 U.S.C. §102(b) as anticipated, or alternatively, under 35 U.S.C. §103 as obvious. Appellants submitted a response on November 22, 2000, along with the Declaration of Reid A. Brennen. On December 8, 2000, an Advisory Action was mailed stating that the response and declaration were unpersuasive because "the closest prior art of record has not been utilized for comparison purposes." A Notice of Appeal was filed on January 19, 2001.

Appellants filed a Brief on March 15, 2001. The Office has objected to the Brief on formal grounds, and this Substitute Brief is submitted to replace that which was originally filed.

### REAL PARTY IN INTEREST

As assignee of the entire right, title and interest in and to the invention claimed in the subject patent application, Agilent Technologies, Inc. is the real party of interest is in this appeal.

### RELATED APPEALS AND INTERFERENCES

Appellants are unaware of any appeals or interferences related to this case.

## STATUS OF CLAIMS

Claims 23-27, 29-46, 48-50, 52-69, 77 and 78 stand finally rejected under 35 U.S.C. §102(b) as anticipated by, or, in the alternative, under 35 U.S.C. §103(a) as obvious over either one of U.S. Patent Nos. 5,638,413 to Kaltenbach et al. or 5,571,410 to Swedberg et al. Remaining claims 1-22, 28, 47, 51, and 70-76 stand withdrawn as a result of restriction.

## STATUS OF AMENDMENTS

In an Amendment Under 37 C.F.R. §1.111 filed on August 22, 2000 (Paper No. 6), appellants clarified by way of amendment to claim 23 that the process by which the claimed substrate is formed increases the substrate surface area by at least 10-fold to 100,000-fold. In addition, claims 77 and 78 were added to recite that the initial surface area of the substrate may be increased by 1,000-fold to 100,000-fold (claim 77) and preferably by 10,000-fold to 100,000-fold (claim 78). No other amendments have been submitted during prosecution, and all amendments have been entered. Accordingly, claims 23-27, 29-46, 48-50, 52-69, 77 and 78 as amended in the aforementioned Amendment Under 37 C.F.R. §1.111 are pending on this appeal and are set forth in the Appendix.

## SUMMARY OF THE INVENTION

The claims on appeal are drawn to high-surface area textured substrate prepared by a process involving subtracting a material from, adding material to, or both subtracting material from and adding material to a substrate surface in a manner effective to produce high-surface area texturing and an increase in surface area of at least 10-fold to 100,000-fold. The process used may involve a lithographic method, laser ablation, laser-assisted chemical etching, or other suitable techniques; see page 17, lines 4-10, of the specification. Examples of such textured surfaces achieved through laser ablation are illustrated in Figures 4A through 4H of the patent application and described in the corresponding section of the specification on pages 32-34 (i.e., in Example 1). Figures 4A through 4H illustrate a "coning" process in which the substrate surface area is dramatically increased. Such dramatic increases in surface area are useful in forming miniaturized devices for conducting liquid phase analysis that employ, for example, one or more modes of separation such as chromatographic and electrophoretic separation techniques, as disclosed in the specification on page 30, line 9 through page 31, line 3.

## ISSUES

In the final Action (Paper No. 7), the Examiner rejected claims 23-27, 29-46, 48-50 and 52-59 under 35 U.S.C. §102(b) or §103 as anticipated by or obvious over either one of Swedberg et al. or Kaltenbach et al., submitted by appellants in the Information Disclosure Statement filed on February 4, 1999. To support the rejections, the Examiner had stated (in an earlier Office Action, Paper No. 5, dated May 22, 2000) that laser ablative techniques are disclosed in each reference and would provide a high surface texturing of the substrate through a subtractive process (Paper No. 5, page 5, 1st full paragraph). The Examiner had further stated that inherency is relied upon in issuing a combination rejection under 35 U.S.C. §102/103. That is, the Examiner characterized laser ablative techniques as inherently giving rise to high-surface area texturing of a substrate through a subtractive process.

The Examiner added that he does not have laboratory facilities in which to measure the surface roughness and corresponding surface area of the substrate of the prior art, and that it was therefore "incumbent on the appellants to rebut the Examiner's allegation of inherency based on Swedberg et al. or Kaltenbach et al. with comparative evidence showing that the teaching of the prior art relied upon by the Examiner do not anticipate and/or render the scope of the protection sought prima facie obvious."

Accordingly, appellants submitted a Response to the Final Rejection on November 21, 2000 along with the Declaration of Dr. Reid A. Brennen Under 37 C.F.R. §1.132; Dr. Brennen is one of the joint inventors of the claimed invention. The Declaration included comparative evidence in the form of two scanning electron micrographs (SEMs). The first SEM illustrates a typical laser-ablated channel that was obtained using a conventional laser ablation method as described in the cited references, the channel having a substantially defect-free surface (see FIG. 11, appended to the Declaration). The second SEM illustrates an imperfectly formed microchannel also prepared using conventional laser ablation as described by the references (see FIG. 12, also appended to the Declaration). As stated in paragraph 8 of the Brennen Declaration, these figures illustrate laser-ablated channels obtained as generally described in Swedberg et al. and Kaltenbach et al. Dr. Brennen compares the aforementioned micrographs with Figures 4A through 4H of the subject patent application, and concludes that the prior art methods (1) do not

substantially increase surface area, and (2) do not result in high surface area texturing. However, the Examiner maintained his rejections in the Advisory Action.

As a result, the issues on appeal are:

(1) whether the invention as claimed is novel over Swedberg et al. and Kaltenbach et al.; and

(2) whether the invention as claimed is nonobvious over Swedberg et al. and/or Kaltenbach et al.

## GROUPING OF CLAIMS

The claims on appeal are grouped as follows:

Group (I) - claims 23-27, 29-35, 39-43, 46, 77 and 78, drawn to a high surface area textured substrate;

Group (II) - claims 36-38, drawn to a high surface area textured substrate prepared using a grayscale mask;

Group (III) - claims 44 and 45, drawn to a high surface area textured substrate prepared using homogeneous texturing or heterogeneous texturing (including continuous heterogeneous texturing and discontinuous texturing);

Group (IV) - claims 48-50, 52-58, 62-66 and 69, drawn to a miniaturized analysis device;

Group (V) - claims 59-61, drawn to a miniaturized analysis device prepared using a grayscale mask; and

Group (VI) - claims 67 and 68, drawn to a miniaturized analysis device prepared using homogeneous texturing or heterogeneous texturing (including continuous heterogeneous texturing and discontinuous texturing).

The claims of each group stand or fall together.

## ARGUMENT

In rejecting the claims, the Examiner relied on two patents, U.S. Patent No. 5,571,410 to Swedberg et al. and U.S. Patent No. 5,638,413 to Kaltenbach et al. Both patents relate to miniaturized analytical devices for handling liquid samples, and do not concern preparation of high surface area textured substrates or substrates in which surface area has been increased by at least an order of magnitude. In issuing the rejections, the Examiner does not point out the

particular sections of the patents on which he relies, but rather generally asserts that the claims are anticipated "since laser ablative techniques are shown within the metes and bounds of these documents thus providing a high surface texturing of the substrate through a subtractive process" (Paper No. 5, page 5, first full paragraph). The cited patents are briefly summarized below.

**Swedberg et al.** is directed to an integrated miniature planar liquid sample handling and analysis device. In particular, the patent relates to miniaturized planar column devices for liquid phase processing, i.e., separation. The patent discloses that features may be provided in a substrate within the device by employing laser ablation (column 12, lines 12-36). That is, laser ablation is used to form channels (e.g., separation microcolumns) and apertures (e.g., liquid introduction and removal means), and surface modification is briefly mentioned (column 22, first full paragraph). The surface treatments involve chemical functionalization, and deposition/adsorption processes, and do not include modification to provide a high surface area textured surface, nor is any method disclosed or suggested as useful for substantially increasing substrate surface area as claimed by appellants. More particularly, there is no disclosure with respect to using laser ablation to increase the surface area of a substrate surface or to provide surface texturing.

**Kaltenbach et al.** is the "parent" of the Swedberg et al. patent, and is directed to miniaturized planar columns in support media for liquid phase analysis. The pertinent sections of this patent are virtually identical to the pertinent sections of the Swedberg et al. patent, and the references will therefore be discussed together herein.

## I. THE HIGH-SURFACE AREA SUBSTRATE CLAIMED BY APPELLANTS IS NOVEL

The first issue on appeal is anticipation, i.e., whether the cited art discloses the subject matter of the claims under 35 U.S.C. §102(b). It is well settled that anticipation requires a showing that all elements of a claimed invention are disclosed in a single prior art reference. *In re Bond*, 15 USPQ2d 1566, 1567 (Fed. Cir. 1990). As the following will demonstrate that the claimed high surface-area substrate and miniature analysis device is neither expressly or inherently disclosed in the cited art, neither Swedberg et al. nor Kaltenbach et al. anticipates the pending claims.

## A. NEITHER SWEDBERG ET AL. NOR KALTENBACH ET AL. EXPRESSLY DISCLOSES THE INVENTIVE SUBJECT MATTER

### 1. GROUP (I) - CLAIMS 23-27, 29-35, 39-43, 46, 77 AND 78

In order for either cited patent to expressly anticipate the rejected claims, there must be disclosure with respect to every element of each claim. *In re Bond,* supra. Claims 23-27, 29-35, 39-43, 46, 77 and 78, as discussed above, are drawn to a high surface area textured substrate. However, neither Swedberg et al. nor Kaltenbach et al. makes any express disclosure with respect to high-surface area texturing. Further, neither patent expressly discloses a method for increasing surface area by at least 10-fold to 100,000-fold. Since independent claim 23 recites a surface area increase of at least 10-fold to 100,000-fold as an element, neither claim 23 nor the claims depending therefrom are expressly anticipated by the cited patents.

### 2. GROUP (II) - CLAIMS 36-38

Furthermore, claims 36-38 incorporate the elements of a number of base claims, including claim 23. Therefore, the subject matter of these claims cannot be expressly anticipated by the cited references for the reasons discussed above with respect to the claims of Group (I). In addition, there is no disclosure in either cited patent with respect to a substrate prepared using a grayscale mask in conjunction with a lithographic, laser ablation method for producing high surface area texturing, as claimed in claims 36-38. Thus, use of a grayscale mask in a lithographic method for forming a high surface area textured substrate provides an independent basis for novelty with respect to claims 36-38.

### 3. GROUP (III) - CLAIMS 44 AND 45

Similarly, claims 44 and 45 incorporate the elements of a number of base claims, including claim 23. Therefore, as above, the subject matter of these claims cannot be expressly anticipated by the cited references for the reasons discussed above with respect to the claims of Group (I). In addition, neither cited patent teaches homogeneous or heterogeneous texturing-- or, for that matter, any texturing-- the added elements in dependent claims 44 and 45. Homogeneous and heterogeneous texturing are also novel aspects of the invention that provide an independent basis for novelty with respect to these dependent claims. Thus, the cited patents,

which do not mention homogeneous or heterogeneous texturing, do not expressly anticipate claims 44 and 45.

#### 4. GROUP (IV) - CLAIMS 48-50, 52-58, 62-66 AND 69

Claims 48-50, 52-58, 62-66 and 69 are drawn to a miniaturized analysis device prepared by a process that involves subtracting material from, adding material to, or both subtracting material from and adding material to a substrate in a manner effective to produce high-surface area texturing of a substrate. However, as discussed above, neither Swedberg et al. nor Kaltenbach et al. makes any express disclosure with respect to devices prepared using high-surface area texturing of a substrate. Since claim 48 is directed to a miniaturized analysis device produced by high-surface area texturing, neither claim 48 nor the claims depending therefrom are expressly anticipated by the cited patents.

#### 5. GROUP (V) - CLAIMS 59-61

Dependent claims 59-61 are directed to a miniaturized analysis device wherein a substrate has been lithographically treated using laser ablation in conjunction with a grayscale mask in order to substantially increase surface area and provide high surface area texturing. The claims are not expressly anticipated by the cited art for reasons discussed above with regard to the claims of Group (II).

#### 6. GROUP (VI) - CLAIMS 67 AND 68

Dependent claims 67 and 68 are directed to a miniaturized analysis device wherein a substrate has been lithographically treated using laser ablation in a manner effective to result in homogeneous or heterogeneous surface texturing. The claims are not expressly anticipated by the cited art for reasons discussed above with regard to the claims of Group (II).

### B. NEITHER REFERENCE INHERENTLY DISCLOSES THE CLAIMED SUBJECT MATTER

Appellants also respectfully disagree with the Examiner's contention that inherency is a proper basis for this rejection. The so-called doctrine of inherency provides that a prior art reference can anticipate and thus invalidate a claim "by inherency" where a process or device as described in the reference would necessarily result in a particular process or device feature, even

though that feature is not expressly disclosed. A corollary of the inherency doctrine is that a patent claim is anticipated by a prior art reference that discloses all of the limitations of the claim even though the reference does not expressly disclose the "inventive concept" of the claim. *See Verdegaal Brothers, Inc. v. Union Oil Company of California*, 2 USPQ 2d 1051 (Fed. Cir. 1987). However, it is also settled law that "[t]he mere fact that a certain thing *may result* from a given set of circumstances is insufficient to prove anticipation." *Electro Medical Systems, S.A. v. Cooper Life Sciences, Inc.*, 34 F.3d 1048, 32 USPQ 1017 (Fed Cir. 1994). Thus, the critical issue in inherency analysis is whether **it necessarily follows** that all elements of a claim are inherently disclosed in a cited reference even though the elements are not expressly disclosed. The issue here, then, is whether laser ablative removal of material from a substrate as disclosed in Swedberg et al. and Kaltenbach et al. **necessarily results** in surface texturing and an increase in surface area by 10-fold to 100,000-fold, as recited in appellants' claims.

Although the Examiner characterized laser ablative techniques as inherently providing high-surface area texturing of the substrate through a subtractive process, this is not the case. Simple geometry dictates that removing material from a solid form always reduces the volume of the form, and the smaller of two solid forms having the same shape will have a smaller surface area. Thus, neither Swedberg et al. nor Kaltenbach et al. inherently discloses high-surface area texturing or a method that dramatically increases the surface area of a substrate through a subtractive process.

### 1. GROUP (I) - CLAIMS 23-27, 29-35, 39-43, 46, 77 AND 78

As pointed out above, claims 23-27, 29-35, 39-43, 46, 77 and 78 are drawn to a high surface area textured substrate. Appellants submit that the disclosure in Swedberg et al. and Kaltenbach et al. with respect to laser ablative removal of material from a substrate surface does not inherently disclose an increase in surface area. For example, laser ablation may be employed to flatten an irregular, uneven or rough surface, thereby producing a smooth surface having a reduced area. Thus, depending on the nature of the original substrate surface, forming features such as microchannels on a surface through laser ablative removal of material does not substantially increase the surface area of the substrate surface as claimed. It should be also evident that forming channels in a substrate surface through laser ablation using prior art techniques does not increase the area of the substrate surface by 10-fold to 100,000-fold. See the

Brennen declaration at paragraph 9. Dr. Brennen states that upon simple visual observation of the scanning electron micrographs obtained of laser-ablated substrate surfaces prepared using the reference method indicates that the prior art method does not result in a substantial increase in surface area or in high surface area texturing.

### 2. GROUP (II) - CLAIMS 36-38

The inherency question with respect to claims 36-38, drawn to a substrate prepared using a grayscale mask in conjunction with a lithographic, laser ablation method for producing high surface area texturing, is whether or not laser ablation as described in Swedberg et al. and Kaltenbach et al. inherently requires the use of a grayscale mask. In general, it will be appreciated by those of ordinary skill in the art that laser ablation may be conducted without a grayscale mask. Neither Kaltenbach et al. nor Swedberg et al. disclose the use of a grayscale mask and there is no reason to assume that such a mask is inherently disclosed by way of the very general description (see column 9, lines 8-15, of Kaltenbach et al.) that one or more masks (in general) may be used.

### 3. GROUP (III) - CLAIMS 44 AND 45

Claims 44 and 45, again, are drawn to a high surface area textured substrate prepared using homogeneous texturing or heterogeneous texturing (including continuous heterogeneous texturing and discontinuous texturing). The inherency question with respect to these claims is whether homogeneous texturing or heterogeneous texturing will necessarily result from laser ablation of a surface as disclosed in the cited reference. Again, and as confirmed by Dr. Brennen in the declaration of record, neither Kaltenbach et al. and Swedberg et al. disclose a method that results in surface texturing, whether heterogeneous or homogeneous. Therefore, these claims are not inherently anticipated by the cited patents.

### 4. GROUP (IV) - CLAIMS 48-50, 52-58, 62-66 AND 69

Claims 48-50, 52-58, 62-66 and 69 are drawn to a miniaturized analysis device having a substrate surface exhibiting high-surface area texturing, wherein the device is prepared by a process that involves subtracting material from, adding material to, or both subtracting material from and adding material to a substrate in a manner effective to produce high-surface area

texturing. For the reasons discussed above with respect to the claims of Group (III), claims 48-50, 52-58, 62-66 and 69 are not inherently anticipated by the cited references.

### 5. GROUP (V) - CLAIMS 59-61

Dependent claims 59-61 are directed to a miniaturized analysis device wherein a substrate has been lithographically treated using laser ablation in conjunction with a grayscale mask in order to substantially increase surface area and provide high surface area texturing. The claims are not expressly anticipated by the cited art for reasons discussed above with regard to the claims of Group (II).

### 6. GROUP (VI) - CLAIMS 67 AND 68

Dependent claims 67 and 68 are directed to a miniaturized analysis device wherein a substrate has been lithographically treated using laser ablation in a manner effective to result in homogeneous or heterogeneous surface texturing. The claims are not expressly anticipated by the cited art for reasons discussed above with regard to the claims of Group (III).

## II. THE HIGH-SURFACE AREA SUBSTRATE CLAIMED BY APPELLANTS IS NONOBVIOUS OVER EACH OF THE CITED PATENTS

The pending claims were also rejected under 35 U.S.C. §103 as obvious over Swedberg et al. or Kaltenbach et al. Appellants continue to traverse the rejection.

The Examiner stated in support of the rejection that each of the two references renders the independent claims *prima facie* obvious, but that "all specific dependent claim limitations may not be specifically pointed out or distinctly claimed" in the cited patents. Nevertheless, the Examiner asserted that such limitations are also *prima facie* obvious modifications to the generic teachings absent objective evidence to the contrary.

To establish *prima facie* obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the reference(s) themselves or in the knowledge generally available to one of ordinary skill in the art, to modify a reference's teaching. Second, there must be a reasonable expectation of success, and third, the prior art reference must teach or suggest all the claim limitations. The teaching or suggestion to make the modification and the reasonable expectation of success must both be found in the prior art, and not based on an

appellant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). In this instance, the three criteria have not been met.

The first criterion has not been met because without prior knowledge of appellants' claimed invention, there is no reason why one of ordinary skill in the art would be motivated to modify the teaching of Swedberg et al. or Kaltenbach et al. to substantially increase the area of a substrate surface and provide a textured surface. As discussed above, neither patent expressly or inherently discloses a substantial surface area increase or surface texturing. Laser ablation is discussed in the cited reference only in terms of forming microfeatures such as channels and apertures, not features that would substantially increase surface area or be tantamount to texturing. With regard to the second criterion, there would be no reasonable expectation of success since there is no suggestion in Swedberg et al. or Kaltenbach et al. that laser ablation would be "expected" to be useful in anything except the disclosed context, preparation of microchannels in a miniaturized separation device. Third, the references neither teach nor suggest the claim limitations, insofar as neither reference describes or inherently discloses a substrate having been modified so as to have high surface area texturing and a substantial, 10-fold to 100,000-fold, increase in surface area.

**A. GROUP (I) - CLAIMS 23-27, 29-35, 39-43, 46, 77 AND 78**

Claim 23 and the claims depending therefrom require a surface area increase of at least 10-fold to 100,000-fold. This means that the claims require a substantial surface area increase of at least one to five orders of magnitude. It would not be obvious in view of either Swedberg et al. or Kaltenbach et al. to increase surface area by such a great extent; as pointed out above, neither reference discloses the use of laser ablation for any purpose other than formation of microchannels and the like in miniaturized separation devices. There is no teaching, disclosure or suggestion that would motivate one of ordinary skill in the art to modify the disclosed method to be used in an entirely different context, preparation of high surface area textured substrates modified so as to have a substantial increase in surface area. Furthermore, there would be no reasonable expectation of success were one to modify the references in this way, since, as noted above, there is no suggestion in Swedberg et al. or Kaltenbach et al. that laser ablation would be "expected" to be useful in anything except the disclosed context, preparation of microchannels in a miniaturized separation device.

Appellants further submit that the Examiner did not consider the cited patents in their entireties as required in an obviousness analysis. *In re Hedges*, 228 USPQ 685 (Fed. Cir. 1986). For example, when read in their entireties, it is clear that Swedberg et al. and Kaltenbach et al. disclose the use of laser ablation only for forming features such as sample processing channels and apertures, and do not disclose or suggest that laser ablation for texturing, or use of laser ablation in any method that would result in texturing. Swedberg et al. also disclose that in a preferred embodiment, channels are made having semicircular cross-sections, and that the channels may be used to form sample processing chambers having a highly symmetrical circular cross section that may be desirable for enhanced fluid flow. *See* Swedberg et al. at column 14, lines 59-67. Thus, it is evident that laser ablation as disclosed in the cited patents is generally used to form smooth and regular features in microanalytical devices, not for texturing or increasing surface area. This certainly does not render obvious an increase in surface area by 10-fold to 100,000-fold as recited by the claims. Smooth surfaces are generally antithetical to both surface "texturing" and surface area enhancement.

Appellants direct the Board to FIGS. 4A through 4H of the application. These figures are scanning electron micrographs of a Kapton® sheet laser ablated through various line-and-space grayscale masks and exemplify substrate surfaces as set forth in the pending claims. FIGS. 4A through 4H illustrate that material is removed from the generally rectangular section of the surface of the sheet through laser ablation. The surface within the rectangular section exhibits high surface-area texturing. As described on page 33, lines 8-13, the high surface area exhibited by these examples is achieved through "coning," a process in which cones are produced on a polymeric surface through laser ablation. It is evident upon comparing the unablated and ablated portions of the substrate surface that an enormous increase in surface area has been achieved by "coning" as a result of ablation. According to the declaration submitted in response to the final rejection, inventor Dr. Reid Brennen estimates that the surface area of the ablated portion of the surface in all figures submitted is at least about one to five orders of magnitude greater than the corresponding unablated portion.

With respect to the Examiner's assertion that such an increase in surface area is obvious, appellants again direct the Board to the declaration submitted in response to the final rejection. Prior use of laser ablation in order to form channels does not result in the invention as claimed. As shown in FIG. 11 in Appendix B of the declaration, laser ablation of Kapton® sheets in order

to form channels, as generally described in Kaltenbach et al. and Swedberg et al., results in generally smooth channel surfaces. Smooth channel surfaces will not exhibit the degree of surface area increase required by the claimed invention. While a flawed ablation process may sometimes result in small surface imperfections and slight coning (*see, e.g.*, FIG. 12 in the Brennen declaration), small surface imperfections and slight coning increase surface area by only a trivial amount. Such a trivial increase in surface area does not suggest an increase in surface area by at least 10-fold to 100,000 fold as is now claimed. In short, neither cited reference suggests the inventive subject matter of the rejected claims.

Thus, the Examiner erred when he stated in the Advisory Action that "the closest prior art of record has not been utilized for comparison purposes." The submission of FIGS. 11 and 12, the micrographs of the channels formed through laser ablation as generally described in Kaltenbach et al. and Swedberg et al., provides a basis for visual comparison with the textured surfaces produced through laser ablation as illustrated in FIGS. 4A through 4H.

**B. GROUP (II) - CLAIMS 36-38**

Further, appellants submit that the Examiner erred in summarily rejecting dependent claims 36-38 under 35 U.S.C. §103. The Examiner has stated that "all specific dependent claim limitations may not be specifically pointed out or distinctly claimed; see Paper No. 5. Nor does the Examiner state why one of ordinary skill in the art would be motivated to modify the teachings of either Swedberg et al. or Kaltenbach et al. by employing a grayscale mask. Thus, the improper use of hindsight was apparently employed with respect to the rejection of dependent claims 36-38, and reversal of this ground of rejection is in order as well.

**C. GROUP (III) - CLAIMS 44 AND 45**

Similarly, the Examiner cited no reference that suggests homogeneous or heterogeneous texturing, nor does the Examiner state why one of ordinary skill in the art would be motivated to modify the teachings of either Swedberg et al. or Kaltenbach et al. to achieve homogeneous or heterogeneous texturing. Thus, the improper use of hindsight was apparently employed with respect to the rejection of dependent claims 44 and 45 as well.

**D. GROUP (IV) - CLAIMS 48-50, 52-58, 62-66 AND 69**

As discussed above, claims 48-50, 52-58, 62-66 and 69 are drawn to a miniaturized analysis device exhibiting high-surface area texturing. As discussed above in section A, the cited patents do not, singly or in combination, suggest an increase in surface area of at least 10-fold to 100,000-fold, as disclosed in the specification on page 14, lines 9-12.

**E. GROUP (V) - CLAIMS 59-61**

Dependent claims 59-61 are directed to a miniaturized analysis device wherein a substrate has been lithographically treated using laser ablation in conjunction with a grayscale mask in order to substantially increase surface area and provide high surface area texturing. The claims are not rendered obvious over the cited art for reasons discussed above with regard to the claims of Group (II), discussed in Section B, above.

**F. GROUP (VI) - CLAIMS 67 AND 68**

Dependent claims 67 and 68 are directed to a miniaturized analysis device wherein a substrate has been lithographically treated using laser ablation in a manner effective to result in homogeneous or heterogeneous surface texturing. The claims are not expressly anticipated by the cited art for reasons discussed above with regard to the claims of Group (III), discussed above in Section C.

## CONCLUSION

Appellants respectful submit, in conclusion, that the claims on appeal define an invention that is novel and nonobvious over the cited art. Accordingly, appellants request reversal of the Examiner's rejections under 35 U.S.C. §102(b) and 35 U.S.C. §103.

Respectfully submitted,

July 10, 2001
Date

By: Louis L. Wu
Louis L. Wu
Registration No. 44,413

Michael J. Beck, Esq.
AGILENT TECHNOLOGIES
Corporate Legal Department
1601 California Avenue, MS 17L-5A
Palo Alto, CA 94304-1126

## APPENDIX (CLAIMS ON APPEAL)

23. A high-surface area textured substrate prepared by a process comprising subtracting material from, adding material to, or both subtracting material from and adding material to a surface of a substrate having a surface area using a subtractive method, an additive method, or both subtractive and additive methods, respectively, to produce high-surface area texturing of the surface that results in an increase in the surface area by at least 10-fold to 100,000-fold.

24. The high-surface area textured substrate of claim 23, wherein the substrate is selected from the group consisting of polymeric materials, ceramic materials, glass materials, metal materials, composites thereof and laminates thereof.

25. The high-surface area textured substrate of claim 23, wherein the substrate is a laser-ablatable substrate.

26. The high-surface area textured substrate of claim 25, wherein the laser-substrate comprises a polyimide.

27. The high-surface area textured substrate of claim 23, wherein the method is a subtractive method.

29. The high-surface area textured substrate of claim 27, wherein the subtractive method is a lithographic method.

30. The high-surface area textured substrate of claim 29, wherein the lithographic method is selected from the group consisting of a direct feature definition method, an intrinsic feature definition method, a secondary masking method, a deposit-and-pattern method, and combinations thereof.

31. The high-surface area textured substrate of claim 30, wherein the lithographic method is a direct feature definition method.

32. The high-surface area textured substrate of claim 30, wherein the lithographic method is an intrinsic feature definition method.

33. The high-surface area textured substrate of claim 32, wherein the feature definition method comprises exposing the surface of a laser-ablatable substrate to a source of laser light.

34. The substrate of claim 33, wherein a laser ablation mask is used to define a pattern of laser light incident on the surface of the substrate.

35. The substrate of claim 34, wherein the laser ablation mask is selected from the group consisting of a laser-light transmissive material comprising laser-light opaque material applied thereto, a laser-light transmissive material comprising laser-light partially transmissive material applied thereto, a laser-light transmissive material comprising laser-light opaque material embedded therein, a laser-light transmissive material comprising laser-light partially transparent material embedded therein, or a laser-light transmissive material comprising a combination of laser-light opaque material applied thereto, laser-light partially transmissive material applied thereto, laser-light opaque material embedded therein, and laser-light partially transparent material embedded therein.

36. The substrate of claim 35, wherein the laser ablation mask is a dot grayscale mask, a line-and-space grayscale mask or a combination thereof.

37. The substrate of claim 36, wherein the laser ablation mask is a dot grayscale mask comprising dots selected from the group consisting of opaque dots, transmissive dots, partially transmissive dots, and combinations thereof.

38. The substrate of claim 36, wherein the laser ablation mask is a line-and-space grayscale mask comprising lines selected from the group consisting of opaque lines, transmissive lines, partially transmissive lines, and combinations thereof.

39. The substrate of claim 33, wherein the exposing of the surface of the substrate is selected from the group consisting of scanning the source of laser light over the surface of the substrate, exposing the surface to laser light using a step-and-repeat protocol, subjecting the substrate to multiple exposures of laser light, and combinations thereof.

40. The substrate of claim 39, wherein a laser ablation mask is used to define a pattern of laser light incident on the surface of the substrate.

41. The substrate of claim 40, wherein the substrate is subject to multiple exposures of laser light and for each of the multiple exposures, the same or a different laser ablation mask, or a combination thereof, is used to define the pattern of the light incident on the surface of the substrate.

42. The substrate of claim 33, wherein a selected area of the substrate is exposed to the source of laser light.

43. The substrate of claim 42, wherein a laser ablation mask is used to define a pattern of laser light incident on the surface of the substrate.

44. The substrate of claim 43, wherein the high-surface area texturing is homogeneous texturing or heterogeneous texturing.

45. The substrate of claim 44, wherein the high-surface area texturing is heterogeneous texturing and further wherein the heterogeneous texturing is selected from the group consisting of continuous heterogeneous texturing and discontinuous texturing.

46. The substrate of claim 27, wherein the subtractive method is a nonlithographic method selected from the group consisting of a laser-assisted chemical etching method and a local roughening method

48. A miniaturized analysis device prepared by a process comprising subtracting material from, adding material to, or both subtracting material from and adding material to the surface of a substrate using a subtractive method, an additive method, or both subtractive and additive methods, respectively, to produce high-surface area texturing of the surface.

49. The miniaturized analysis device of claim 48, wherein the substrate is selected from the group consisting of polymeric materials, ceramic materials, glass materials, metal materials, composites thereof and laminates thereof.

50. The miniaturized analysis device of claim 48, wherein the method is a subtractive method.

52. The miniaturized analysis device of claim 50, wherein the subtractive method is a lithographic method.

53. The miniaturized analysis device of claim 52, wherein the lithographic method is selected from the group consisting of a direct feature definition method, an intrinsic feature definition method, a secondary masking method, a deposit-and-pattern method, and combinations thereof.

54. The miniaturized analysis device of claim 53, wherein the lithographic method is a direct feature definition method.

55. The miniaturized analysis device of claim 53, wherein the lithographic method is an intrinsic feature definition method.

56. The miniaturized analysis device of claim 55, wherein the feature definition method comprises exposing the surface of a laser-ablatable substrate to a source of laser light.

57. The miniaturized analysis device of claim 56, wherein a laser ablation mask is used to define a pattern of laser light incident on the surface of the substrate.

58. The miniaturized analysis device of claim 57, wherein the laser ablation mask is selected from the group consisting of a laser-light transmissive material comprising laser-light opaque material applied thereto, a laser-light transmissive material comprising laser-light partially transmissive material applied thereto, a laser-light transmissive material comprising laser-light opaque material embedded therein, a laser-light transmissive material comprising laser-light partially transparent material embedded therein, or a laser-light transmissive material comprising a combination of laser-light opaque material applied thereto, laser-light partially transmissive material applied thereto, laser-light opaque material embedded therein, and laser-light partially transparent material embedded therein.

59. The miniaturized analysis device of claim 58, wherein the laser ablation mask is a dot grayscale mask, a line-and-space grayscale mask or a combination thereof.

60. The miniaturized analysis device of claim 59, wherein the laser ablation mask is a dot grayscale mask comprising dots selected from the group consisting of opaque dots, transmissive dots, partially transmissive dots, and combinations thereof.

61. The miniaturized analysis device of claim 59, wherein the laser ablation mask is a line-and-space grayscale mask comprising lines selected from the group consisting of opaque lines, transmissive lines, partially transmissive lines, and combinations thereof,

62. The miniaturized analysis device of claim 56, wherein the exposing of the surface of the substrate is selected from the group consisting of scanning the source of laser light over the surface of the substrate, exposing the surface to laser light using a step-and-repeat protocol, subjecting the substrate to multiple exposures of laser light, and combinations thereof.

63. The miniaturized analysis device of claim 62, wherein a laser ablation mask is used to define a pattern of laser light incident on the surface of the substrate.

64. The miniaturized analysis device of claim 63, wherein the substrate is subject to multiple exposures of laser light and for each of the multiple exposures, the same or a different laser ablation mask, or a combination thereof, is used to define the pattern of the light incident on the surface of the substrate.

65. The miniaturized analysis device of claim 56, wherein a selected area of the substrate is exposed to the source of laser light.

66. The miniaturized analysis device of claim 65, wherein a laser ablation mask is used to define a pattern of laser light incident on the surface of the substrate.

67. The miniaturized analysis device of claim 66, wherein the high-surface area texturing is homogeneous texturing or heterogeneous texturing.

68. The miniaturized analysis device of claim 67, wherein the high-surface area texturing is heterogeneous texturing and further wherein the heterogeneous texturing is selected from the group consisting of continuous heterogeneous texturing and discontinuous heterogeneous texturing.

69. The miniaturized analysis device of claim 50, wherein the subtractive method is a nonlithographic method selected from the group consisting of a laser-assisted chemical etching method and a local roughening method.

77. The substrate of claim 23, wherein the increase in the surface area is at least 1,000-fold to 100,000-fold.

78. The substrate of claim 77, wherein the increase in the surface area is at least 10,000-fold to 100,000-fold.